

Backend as a Service (BaaS)

Seminar TIE-11406, Fall 2013
Tampere University of Technology

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<http://www.cs.tut.fi/~taivalaari/kurssit/BaaS2013/>

Motivation and Background

- The landscape of mobile software development has changed considerably in the past ten years.
- Today's mobile applications are rarely standalone; rather, application must commonly
 1. talk with various third party data services,
 2. work on a number of different platforms, and
 3. stay in sync across a number of devices that the user has.
- The dependence on various backend features has led to the emergence of *Backend as a Service (BaaS)* systems.

Practical Arrangements

Practical Arrangements

- The seminar will be held on **Tuesdays in Tietotalo TB222, 14:15 – 15:45.**
- Seminar is based on presentations given by participants.
- Active participation expected.
- Getting volunteer presenters for next weeks is essential for the overall success of the seminar.
- Dates are flexible at this point.

How to Get Credit Points (Opintopisteet)?

- **Number of credit points: 1-5 op**
- Regular attendance: 1 op
- Seminar presentation on selected BaaS technology: 2 op
- Successfully written, new demo application using selected BaaS technology: 2 op

Choosing Presentation & Demo Topics

- Please choose your presentation topic, possible demo application and preferred presentation date(s) as soon as possible.
- Send e-mail to: **kari.systa@tut.fi**
- Topics are allocated on a “first-come-first-server” basis.
- Seminar web page will be updated regularly to list the reserved presentation topics:
 - <http://www.cs.tut.fi/~taivala/kurssit/BaaS2013/>

Action Items for Next Week

1. Choose your presentation topic.
2. Optionally or in addition, come up with a great idea for a demo application.
3. Pick a date for your presentation(s).
 - Send e-mail to: kari.systa@tut.fi

Backend as a Service

Overview

Backend as a Service (BaaS)

- **Backend as a Service:** *a model for providing web and mobile app developers with a way to link their applications to hosted backend cloud storage while also providing features such as user management, push notifications, and integration with social networking services, all as an integrated offering.*
- Key goal is to **abstract away all the complexity related to cloud and cloud management**, and provide simple APIs that can be used across all popular mobile platforms.
 - “Don’t worry about the server side, we’ll take care of it for you.”
- This is a very popular area these days; 40+ startup companies in this area have sprung up recently.

Partial List of BaaS Systems / Companies

- <http://www.anypresence.com/>
- <http://www.apiomat.com/>
- <http://www.appcelerator.com/>
- <http://www.appery.io/>
- <http://www.applicasa.com/>
- <http://www.applicationcraft.com/>
- <http://www.apstrata.com/>
- <http://www.baasbox.com/>
- <http://www.backendless.com/>
- <http://www.catavolt.com/>
- <http://www.cloudmine.me/>
- <http://www.convertigo.com/>
- <http://www.deployd.com/>
- <http://www.dreamfactory.com/>
- <http://www.fatfractal.com/>
- <http://www.feedhenry.com/>
- <http://www.icenium.com/>
- <http://www.innoquant.com/>
- <http://www.instanext.com/>
- <http://www.jaystack.com/>
- <http://www.kii.com/>
- <http://www.kinvey.com/>
- <http://www.kumulos.com/>
- <http://www.mobdb.net/>
- <http://www.netmera.com/>
- <http://www.openmobster.com/>
- <http://www.parse.com/>
- <http://www.proxomo.com/>
- <http://www.quickblox.com/>
- <http://www.shephertz.com/>
- <http://www.sencha.com/products/space/>
- <http://www.stackmob.com/>

Key Selling Points for BaaS Systems

- **Writing and hosting a full-fledged cloud backend can be very tedious and expensive.**
- **Small developers do not have the resources or skills to write or host their own backends anyway.**
- **Backend offerings from major providers such as Amazon can be unnecessarily complex for small developers.**
- **Many BaaS systems are very easy to take into use.**
 - **To get started, often just a line or two of code in your web app is needed; excellent online documentation provided by most systems.**
- **Part of the value proposition is pricing. Most systems use the freemium model; small-scale use is usually free.**

BaaS – Commonly Provided Features

Data Storage



Push Notifications



3rd Party Data Integration



Cross-Platform Support



User Management



Versioning, analytics, etc.



Data Storage

Data Storage



- Most of the BaaS systems offer a *Data API* for storing application data in the cloud.
- File storage is usually provided as well (for large images, file attachments, etc.)
- Commonly, these APIs are offered in a number of different forms.
 - JavaScript API
 - REST API
 - native APIs for iOS, Android, (sometimes) WP
- The actual APIs / databases are still rather different (JSON or key-value stores, table-oriented DBs, SQL support, etc.).

Push Notifications

Push Notifications



- A push notification API allows users to be instantly notified of data changes in 3rd party services as well as changes across the user's own devices.
 - No battery consuming polling required.
- On device side, push support is often limited to iOS and Android devices
 - Google Cloud Messaging (GCM)
 - Apple Push Notification (APN)
 - Some systems (e.g., QuickBlox) support Microsoft Push Notifications as well

Third Party Data Integration

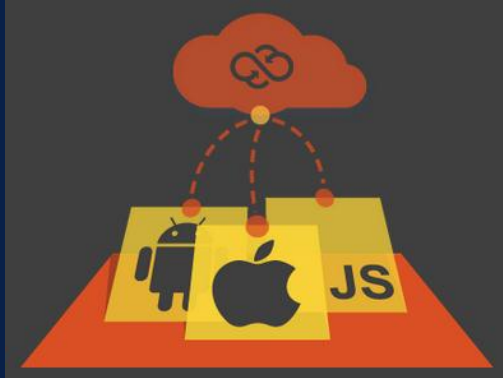
3rd Party Data Integration



- Most of the BaaS systems offer APIs for third-party data integration.
- Depending on platform focus, 3rd party support is either *consumer-oriented* or *enterprise-oriented*.
- **Consumer-oriented:**
 - Integration with social networking (Facebook, Twitter, Flickr) and location services (Foursquare, Google Places, etc.)
- **Enterprise-oriented:**
 - Integration with LDAP, Oracle, PeopleSoft, Salesforce.com, SAP, Siebel, etc.

Cross-Platform Support

Cross-Platform Support



- Most of the BaaS backends offer Web APIs (JavaScript, REST) as well as native APIs for iOS and Android.
- Most of the functionality and APIs offered can be used from pure web apps, as well as from iOS and Android applications.
- At the moment, only a few systems provide support for Windows Phone development.

User Management

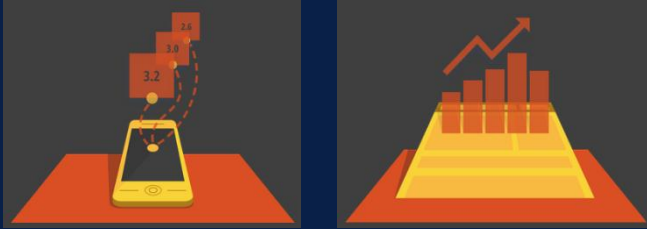
User Management



- User management is needed for multi-device use as well as for third-party data integration.
- BaaS systems typically offer [a subset of] the following mechanisms:
 - OAuth and/or OAuth 2.0, OpenID
 - Google Account, Apple ID, Microsoft Live, Twitter, Facebook logins.
 - Enterprise integration with LDAP.
- For security, the systems rely on common technologies (HTTPS, SSL/TLS); server-side data is usually encrypted.

Additional Features

Versioning, analytics, etc.



Additional differentiating features available in some systems:

1. Data analytics / logging capabilities
2. API / Data versioning support
3. Server-side code execution support
4. Application / plugin marketplace
5. Multi-platform UI generation /
UI authoring tools / widget libraries

Broader Classification

DBaaS

- Cloud database
- Cloud file storage
- Access control
- Push notifications
- Offline support (sync)

AWS DynamoDB
Cloudant
Cloudbase
Dropbox
Firebase
...

BaaS

- Integration to third party services and authentication systems (via OAuth, LDAP)
- Server-side computation
- Analytics & monetization
- Client-server communication
- User management
- Device management

CloudMine
Buddy
FeedHenry
Kinvey
Parse
...

PaaS

- All-in-One IDE/SDK for multi-platform development
- Multi-platform UI/application framework
- Multi-platform building and deployment

Appcelerator
Appery.io
ApplicationCraft
Icenium
Sencha.io
...

Example Feature Set: Parse



Parse Data

Store your app's data in the cloud.
No servers necessary.

Parse Hosting

A powerful web presence without all the hassle.



Parse Push

Creating, scheduling, and segmenting push notifications just got a whole lot easier.



One platform to rule them all



Parse Social

Make your app social. Instantly.



Cloud Code

Run custom app code in the Parse Cloud.
Say goodbye to servers.

Usage Example – Parse Data API

https://parse.com/docs/js_guide

```
var GameScore = Parse.Object.extend("GameScore");
var gameScore = new GameScore();

gameScore.save({
  playerName: 'New Player',
  score: 1000, cheatMode: false
}, {
  success: function(gameScore) {
    // Execute any logic that should take place after the object is saved.
  },
  error: function(gameScore, error) {
    // Execute any logic that should take place if the save fails.
    alert('Failed to create new object, error code: ' + error.description);
  }
});
```

Business Term Example – Parse

Basic	Pro	Enterprise						
Great for developers to get started	For production applications	The most advanced features at a custom annual price						
FREE	\$199 per month	Discover all the benefits of the enterprise plan Learn more						
<table><tr><td>Requests 1 million/month</td><td>Pushes 1 million/month</td><td>Burst Limit 20/second</td></tr></table>	Requests 1 million/month	Pushes 1 million/month	Burst Limit 20/second	<table><tr><td>Requests 15 million/month</td><td>Pushes 5 million/month</td><td>Burst Limit 40/second</td></tr></table>	Requests 15 million/month	Pushes 5 million/month	Burst Limit 40/second	
Requests 1 million/month	Pushes 1 million/month	Burst Limit 20/second						
Requests 15 million/month	Pushes 5 million/month	Burst Limit 40/second						
Parse Core Platform	Parse Core Platform <ul style="list-style-type: none">+ Collaborators and security features+ Powerful marketing features	Parse Core Platform <ul style="list-style-type: none">+ Parse Pro features+ Enterprise-grade SLA+ High performance infrastructure+ Dedicated support						
Choose plan	30-day Free trial Choose plan	Choose plan						

Business Term Example – Kinvey

Building it

\$0

per month

0-100
active users

Developing on Kinvey is always free.
Period.

Growing it

\$20

per month

101-1,000
active users

Once you pass 100 users, you will
incur a monthly charge of at least \$20
until you remove your app.

Scaling it

+

\$7

per month

For each additional
1,000 active users
(up to 50,000)

Please contact us at (617) 505-4096 or
write to us to discuss rates for even
bigger scale (more than 50,000 active
users).

Survey of Popular BaaS Systems

- We are currently preparing a research report on popular BaaS systems.
- Survey was started by narrowing down the number of potential systems based on a DeveloperEconomics study:
 - <http://www.developereconomics.com/parse-leads-with-28-but-competition-for-second-spot-is-heating-up-as-baas-rises-in-popularity/>
 - <http://www.developereconomics.com/backend-as-a-service-shootout-the-best-alternatives-to-parse/>
- 15 systems chosen for more detailed inspection.

BaaS Landscape – January 2013

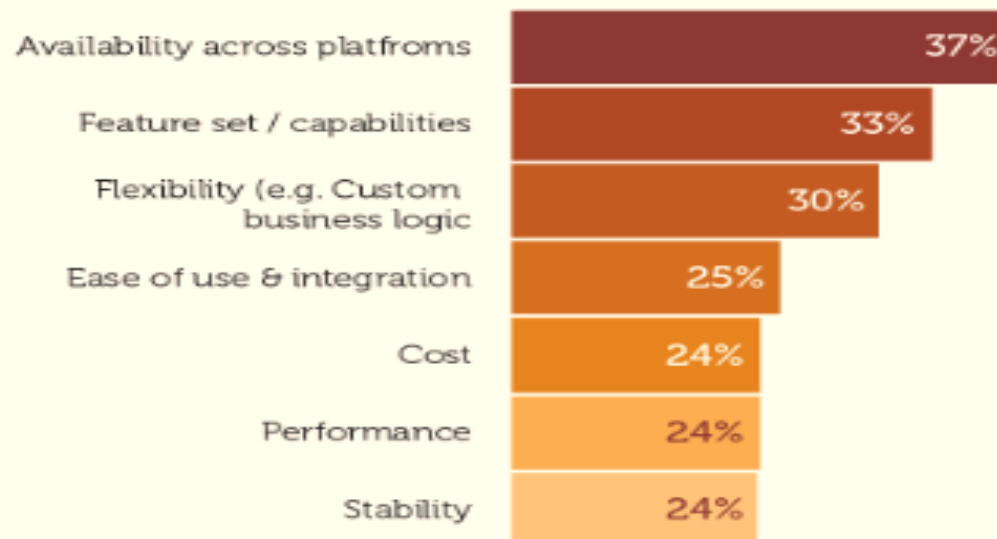
Mindshare

% of developers using service among developers using mobile Back-end services (n=387, median, weighted)



Selection Criteria

Reasons for selecting a Back-end service (n=384, weighted)

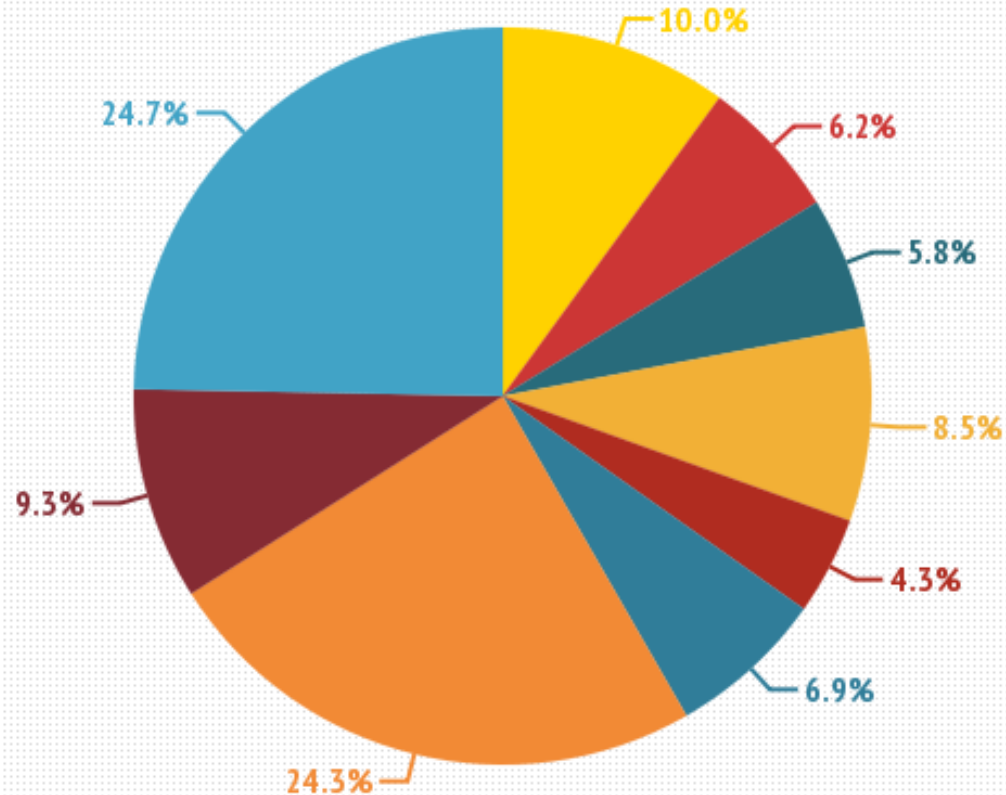


% of developers using Back-end services on 5 major platforms:



BaaS Landscape – May 2013

Percentage of developers using each solution as their primary BaaS (n=259).



ACS Applicasa Buddy CloudMine Deployd mobDB Parse sencha.io Others

Average developer ratings across the 7 criteria rated most important for this type of service (n=195).



Availability across platforms Feature set Flexibility Ease of integration Cost Performance Stability

Summary of Most Prominent BaaS Systems

Most Popular Systems	Most Recommended Systems	Most Feature-Rich Systems
<ol style="list-style-type: none">1. Parse2. Sencha3. CloudMine4. Appcelerator ACS5. Buddy6. MobDB7. StackMob8. Flurry9. Applicasa10. QuickBlox	<ol style="list-style-type: none">1. Parse2. Sencha3. CloudMine4. Kinvey5. Buddy6. Appcelerator ACS7. Feedhenry8. QuickBlox9. MobDB10. Applicasa	<ol style="list-style-type: none">1. Parse2. Appcelerator ACS3. Sencha4. CloudMine5. MobDB6. Deployd7. Apigee8. StackMob9. Flurry10. QuickBlox

Highlights of Most Popular BaaS Systems

- **Parse:** The most popular BaaS platform for consumer apps. Has a good set of features and a wide range of target platforms, but does not support conflict resolution or enterprise features. Recently acquired by Facebook.
- **Sencha.io:** Originally a HTML5 Touch UI toolkit, later an app framework, and more recently adding BaaS capabilities (“the first mobile HTML5 cloud”). BaaS features limited to push notifications and social networking (Facebook) integration. Own app marketplace supported.
- **CloudMine:** Enterprise-oriented system that provides an impressive set of data connectors for enterprise software, including Oracle, PeopleSoft, SAP and Siebel.

Highlights of Most Popular BaaS Systems

- **Appcelerator ACS:** Uses its own authoring tool (Titanium) and UI language, although app logic is written in JavaScript. Rich SDK with fairly limited core functionality; extendable with various third party plugins. Own app marketplace supported.
- **Kinvey:** Comprehensive platform offering both consumer and enterprise features. Integrates also with Google App Engine.
- **Google Mobile Backend Starter:** A new, minimalistic, generic storage and messaging backend that can be auto-deployed on Google App Engine. A sample Android app that includes a client library for the backend is provided. By extending the sample backend you can access all the Google Cloud APIs.

Highlights of Other BaaS Systems

With Consumer/UI/Gaming Orientation

- **Applicasa**: Mainly oriented towards games; tries to minimize coding , e.g., by providing a drag-and-drop interface for defining database tables. Supports Unity as a separate platform in addition to iOS and Android.
- **QuickBlox**: Similar to Applicasa; oriented towards "thick client, thin server" apps focusing on client-side features. Supports video chat, augmented reality, maps and Unity.
- **Deployd**: An easy-to-use open source Node.js module that makes it easy to write self-hosted web app backends running on MongoDB. There are plans to provide Deployd as a hosted service (currently in alpha).

Highlights of Other BaaS Systems

With Enterprise Orientation

- **Apigee**: Enterprise-oriented system that was recently positioned as a BaaS offering; main differentiator is the ability to write server-side API adapters.
- **FeedHenry**: Enterprise-oriented system with well thought-out core features, e.g., data sync can be adapted to other backends. Some features missing, e.g., no built-in social network integration is provided.
- **StackMob**: Comprehensive platform with offline support and synchronization capabilities with custom conflict resolution (iOS only for now), API versioning, and own marketplace for extending platform functionality with 3rd party add-ons.

Highlights of Other BaaS Systems

With Data Analytics Orientation

- **Buddy**: Simple platform with analytics as the main selling point.
- **Flurry**: Purely an advertisement and analytics platform.
- **MobDB**: Storage backend running on AWS that lets you easily define and access database tables. Supports push notifications and analytics. Provides a web interface for backend management.

Feature Comparison

System	Data API	Push notif	User mgmt	3rd party integr.	Analytics	Server code	Market place	WP support	Differentiators
Apigee	X	X	X	X	X	(X)	(X)		Enterprise focus
Appcelerator	X	X	X	X		(X)	X	(X)	Own UI authoring SDK
Applicasa	X	X	X	X	X				Gaming, analytics focus
Buddy	X	X	X		X			X	Analytics focus
CloudMine	X	X	X	X	X	X			Enterprise connectors
Deployd	X	(X)	X			X		(web)	Open source, self-host
FeedHenry		X	X	(X)	X	X		(X)	Enterp focus; device APIs
Flurry					X			X	Analytics focus
Google MBS	X	(X)	(X)		(X)	(X)			Android/App Eng focus
Kinvey	X	X	X	X	X	X			Excellent documentation
MobDB	X	X	X		X				Storage/analytics focus
Parse	X	X	X	X	X	X		X	Excellent documentation
QuickBlox	X	X	X	X			(X)	X	Chat/video focus
Sencha.io	X	X	X	(X)			X	(X)	Client-side focus
StackMob	X	X	X	X	X	X	X		API versioning, offline

Database as a Service (DBaaS)

- There are a number of companies that offer subsets of BaaS functionality, usually focusing on storage and push notifications:
 - <https://cloudant.com/>
 - <http://www.cloudbase.io/>
 - <https://cloud.google.com/products/cloud-storage>
 - <http://www.dropbox.com/>
 - <http://aws.amazon.com/simplifiedb/>
 - <http://www.firebase.com/>
- The basic value proposition is the same – build cloud-oriented applications fast without worrying about backend development or management.

Usage Example – Firebase

// Boilerplate

```
<script src='https://cdn.firebase.com/v0/firebase.js'></script>
```

// Open database

```
var db = new Firebase('https://mydb.firebaseio.com/');
```

// Write data

```
db.push({name: "New Player", gameScore:1000 });
```

// Read data & listen to change notifications

```
db.on("value", function(data) {  
    renderMessage(data.val());  
});
```

Summary and Key Takeaways

- Mobile software development is changing (again).
- Developers no longer write applications against a specific mobile platform.
- Rather, they must actively:
 - target number of platforms (iOS, Android, WP, Web),
 - write apps that talk with numerous 3rd party data services,
 - stay in sync across multiple devices.
- BaaS systems aim at providing the necessary backend functionality, and relieving the programmers from having to develop, host or maintain backend functionality.

Summary and Key Takeaways

- There is a lot of competition in this area (40+ companies).
- At the moment, the features and the maturity of the systems still vary considerably.
- Core functionality has started converging (e.g., data APIs, push notifications, 3rd party API integration, platform support, analytics capabilities).
- At the moment, only a few systems support Windows Phone development.
- At least the following systems deserve a closer study: Parse, Kinvey, Deployd, Firebase.

Action Items for Next Week

1. Choose your presentation topic.
 2. Optionally or in addition, come up with a great idea for a demo application.
 3. Pick a date for your presentation(s).
- Send e-mail to: kari.systa@tut.fi

Proposed Outline for Presentations

1. Introduction
2. Overview of the system and its design principles
3. Small examples or existing demos
4. Walkthrough of a more complete example illustrating the use of the technology
5. Evaluation (benefits, drawbacks, peculiarities, usefulness of the system to relevant problems, possible measurements, ...)
6. Summary

Kiitos!
Thank You!

Backend as a Service – Ecosystem Map

